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Tailoring cancer care with AI system

Singapore team's work optimises drug selection, dosage to treat diseases for best possible outcome

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Science Editor

One patient, one treatment. Tailored for him and only for him.

Two lifelong buddies who moved to Singapore from California have created an artificial intelligence system which, they believe, optimises drug selection and calculates the optimum dose of one, or a combination of drugs, that any individual needs to treat a disease, with maximum results and minimum side effects.

Professor Dean Ho, director of the Singapore Institute for Neurotechnology (Sinapse) at the National University of Singapore (NUS), and Assistant Professor Edward Chow, principal investigator at the Cancer Science Institute of Singapore, say they have had positive results in small-scale clinical trials so far.

More than 30 patients have been treated successfully with QPOP (Quadratic Phenotypic Optimisation Platform) and CURATE.AI, as the complementary platforms are called, for cancers and infectious diseases, as well as for cognitive training to improve brain function, according to NUS.

And the research team is currently recruiting 195 participants for three different clinical trials, in multiple myeloma – a form of cancer – liver transplant immunosuppression and cognitive training.

Both platforms work in tandem: QPOP uses cells and animals to select the drugs that give the best possible efficacy and safety, while CURATE.AI modulates the dosing of these combinations in patients for the best results for the entire duration of care.

At the heart of the process is the discovery that for every disease and patient, drugs and doses are tied to efficacy and safety in a manner which can be mapped out in a horseshoe-shaped curve called a parabola.

Using this formula, the dosages are plotted using each patient's own clinical data, based on blood tests for instance, for indicators of efficacy and safety, as well as biomarkers that indicate cancer progression and toxicity.

The programme continuously assesses how well the patient responds to the drugs, with the doses adjusted accordingly. This information is used to create an individualised CURATE.AI profile, or map, that identifies the drug doses which allow the best possible treatment outcome at any given point in time.

"We're addressing what had previously been thought to be impossible," said Dr Ho. "We're finding out the right drugs at the right dose for an individual in a sustained fashion."

Patients are generally given medication at standard doses, Dr Chow explained, but a one-size-fits-all approach does not work because each individual is different and responds to drugs differently.

The studies, Dr Ho noted, have highlighted how profoundly dosing can affect the efficacy and safety of treatment, and sometimes in surprising ways.

In one case, the AI platform suggested halving the drug dosage for a patient with prostate cancer, counter to what traditional cancer treatment would prescribe – which would generally be to increase drug dosages until they no longer work, followed by exploring other treatment options.

But under the new regime, he noted, the patient had the lowest levels of the tumour marker observed during the clinical study, and his tumour lesions shrank. He is currently back to his normal, active lifestyle.

Doctors familiar with the platform are enthusiastic about its potential.

Professor Dean Ho (right), director of Sinapse at NUS, and Assistant Professor Edward Chow, principal investigator at the Cancer Science Institute of Singapore, created the AI system.
ST PHOTO: KHALID BABA

HUGE POTENTIAL

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DR ALI ZARRINPAR, an associate professor in the division of transplantation and hepatobiliary surgery at the University of Florida College of Medicine, who worked with the research team several years ago to do a preliminary exploratory trial, comparing standard-of-care dosing of an immunosuppression drug to AI-optimised dosing.

Dr Ali Zarrinpar, an associate professor in the division of transplantation and hepatobiliary surgery at the University of Florida College of Medicine, worked with the team several years ago to do a preliminary exploratory trial, comparing standard-of-care dosing of an immunosuppression drug to AI-optimised dosing. This led to positive results and funding from the US National Institutes of Health for a larger study, he said.

"This platform is very flexible and can be applied to a large variety of therapeutic ends," he said.

"Because it systematically allows for optimisation of multicomponent therapy in fewer tries, it has a huge potential to improve care and personalise treatment."

Added Dr Steven Rosen, provost and chief scientific officer of leading cancer research and treatment centre City of Hope, who is currently collaborating on a QPOP drug selection project: "Our collaborative work is currently preclinical, but I feel it holds great promise."

In Singapore, Dr Chng Wee Joo (director) and Dr Goh Boon Cher (deputy director) of the National University Cancer Institute are planning to use the platform on a clinical trial with multiple myeloma patients in June.

Dr Chng said that in preclinical work, the team had used the platform to uncover a new drug combination that works in myeloma resistant to Bortezomib, a standard form of treatment. "We will want to conduct a trial using this combination," he said, adding that another randomised trial of the platform's predicted combination versus standard treatment chosen by a physician was in the works.

Added Dr Goh: "The strategy to select and dose patients with AI platforms is extremely exciting, and aims at better precision, which has potential to improve outcome, and save costs."

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